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Analysis of Complications related to Endovascular Therapy for Dural Arteriovenous Fistulae

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Summary

In this paper, we reviewed our cases of dural arteriovenous fistulae (dural AVFs) and analyzed periprocedural complications. In 157 procedures, we encountered 14 complications. Overall, complication rate of 9% was seen. We divided these complications into five subgroups such as cranial nerve palsy, coil-related trouble, thromboembolic complication, vessel perforation, and radiation-related trouble.

There were five transient abducent nerve palsies in cases with cavernous sinus dural AVFs. There were two cases of coil unraveling and two cases of coil migration. In two cases, direct puncture of the internal jugular vein was performed to retrieve the unraveled coil by using dual microcatheter and guidewire snare technique. We encountered two thromboembolic complications. In one case, venous infarction was recognized after polyvinyl alcohol particle embolization. In two cases of vessel perforations, there were no new neurological deficits except one case with transient Gerstmann syndrome. In endovascular treatment of dural AVF, serious complications are rare and can be prevented if maximum attention is paid during the procedure.

Introduction

In cases of dural AVFs, the chances to be treated with endovascular therapy have been increasing according to the improvement of devices and techniques [1-3]. Serious complications are decreasing, however, there are still minor complications which do not cause major deficits [4].

In this paper, we reviewed our cases of dural AVFs treated with endovascular therapy and analyzed periprocedural complications.

Material and Methods

We performed 157 endovascular procedures for 98 patients in our institution and branch hospitals until December 2002. The location of dural AVFs were as follows: cavernous dural AVF (CS dural AVF) 51 patients (52%), transverse-sigmoid sinus dural AVF (TS-SS dural AVF) 34 patients (35%), superior sagittal sinus dural AVF (SSS dural AVF) six patients (6%) and other dural AVF seven cases (7%). We reviewed periprocedural complication in these patients.

Results

In 157 procedures, we encountered 14 complications. Overall, complication rate was 9%, and mortality rate was 0%. Morbidity rate was 2%, in which cerebral infarction and skin necrosis were included. We divided these complications into five subgroups such as cranial

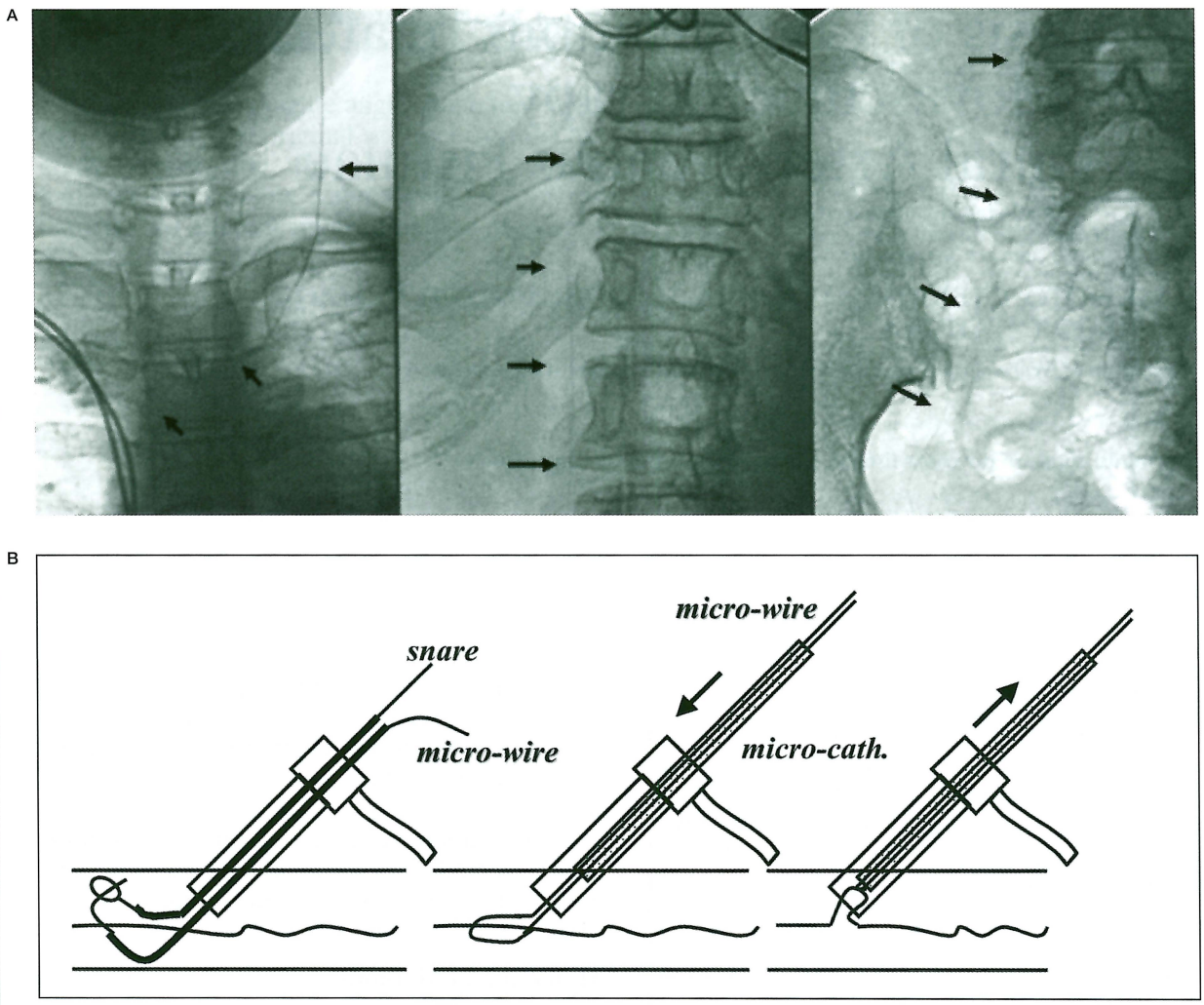


Figure 1 A) Plain neck, chest, and abdominal radiograph. The broken coil remained stretched from the cavernous sinus to the right femoral vein. B) Our method of retrieval of the stretched mechanically detachable coil from the internal jugular vein.

nerve palsy, coil-related trouble, thromboembolic complication, vessel perforation, and radiation-related trouble.

Cranial Nerve Palsy

There were 5 cranial nerve palsies. All cases were CS dural AVFs and suffered from abducent nerve palsy. In these cases, we used anticoagulation during embolization. All abducent nerve palsies were transient, lasting from 10 days to three months.

Coil-related Trouble

There were two cases of coil unraveling and two cases of coil migration. We could retrieve coils in three cases. In two of three cases, we needed direct puncture of the internal jugular vein to retrieve unraveled coil by using dual microcatheter and guidewire snare technique[5].

Representative Case 1

A 56-year-old woman suffered from severe chemosis and right orbital pain. Cerebral angiography showed a CS dural AVF. Transvenous embolization was started using mechanically detachable coils (MDCs).

When the fourth MDC was inserted, the coil stretched, unraveled and finally detached inside the catheter, extending from the cavernous sinus to the right femoral vein (figure 1A). We attempted to retrieve the broken coil by a 4

mm goose-neck snare via transfemoral route. However, because of the weakness of the unraveled coil, the attempted retrieval was abandoned. Then, the transjugular route was tried, from 5F sheath introduced into the left internal jugular vein. A 0.014-inch micro-guide wire was advanced through a 3F catheter. The tip of this guidewire was grabbed by a 4 mm goose-neck snare wire and withdrawn from the sheath and cut to the appropriate length. A 3F catheter was introduced over the ends of the pulled-out guidewires. This catheter was then advanced to snare and retrieve the non-stretched portion of the residual coil (figure 1B).

Thromboembolic Complication

We encountered two thromboembolic complications. In one case, ascending branch of middle cerebral artery was occluded at the final angiogram after embolization, and the patient suffered from left hemiparesis permanently. In a case of the SSS dural AVF, cortical vein was occluded by polyvinyl alcohol (PVA) particles passing through the dural arteriovenous shunt during transarterial embolization from the occipital artery. He suffered from transient right hemiparesis.

Representative Case 2

A 76-year-old man with disturbance of consciousness, convulsion and right hemiparesis was admitted to our hospital. Cerebral angiography showed a SSS dural AVF with cortical venous reflux (figure 2A,B). The feeding arteries were bilateral middle meningeal and left occipital arteries. Because the patient had disturbance of consciousness, we attempted transarterial embolization to reduce the arteriovenous shunt flow at first. The left middle meningeal and occipital arteries were embolized with 350-500μ m PVA particle. After transarterial embolization, his hemiparesis was gradually aggravated from 4/5 to 1/5 in manual muscle test. MRI showed venous infarction in the left frontal lobe (figure 2C). We considered that

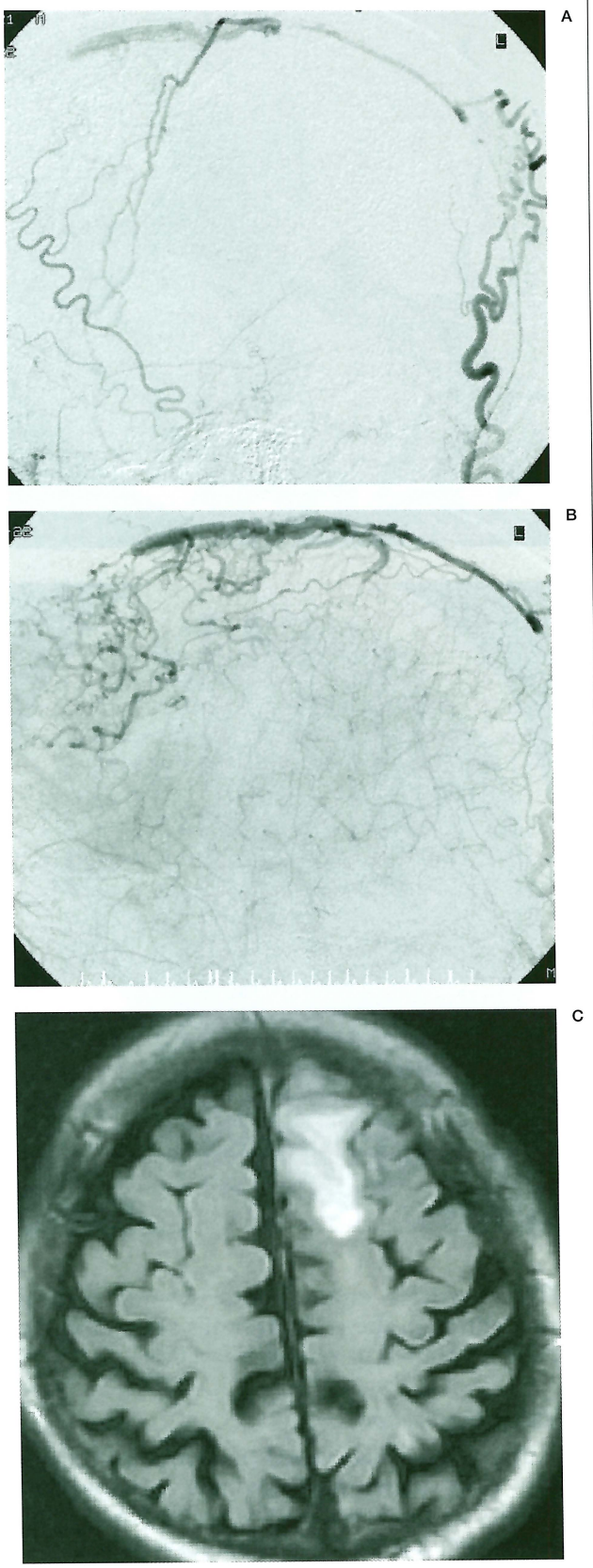
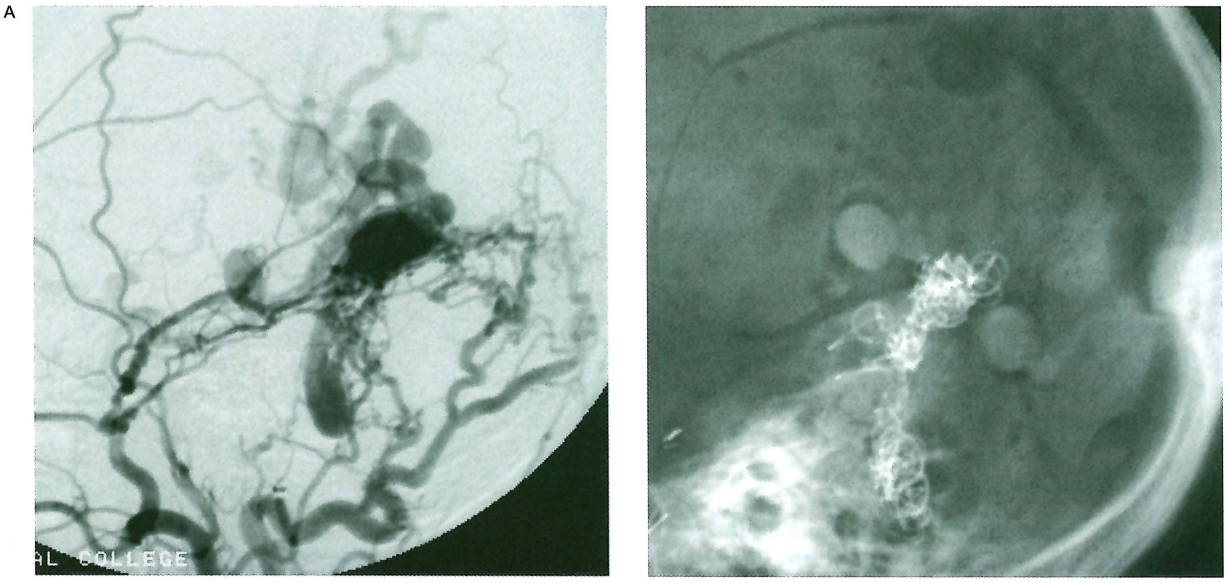


Figure 2 A) Left external carotid angiogram (lateral view, arterial phase). The SSS dural AVF was fed by the middle meningeal and occipital arteries. B) Left external carotid angiogram (lateral view, venous phase). Cortical venous reflux was recognized. C) Post-embolization MRI (FLAIR image). Venous infarction was recognized in the left frontal lobe.



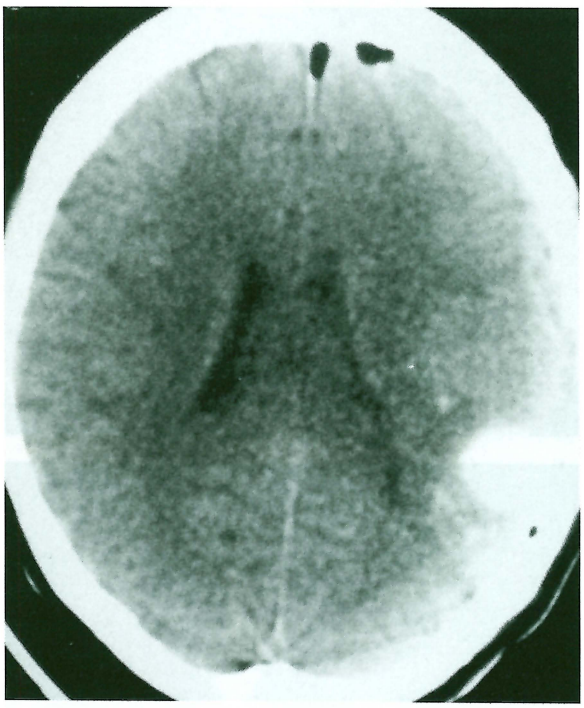


Figure 3 A) Left external carotid angiogram (lateral view). The left TS-SS dural AVF with an isolated sinus was recognized. B) Plain craniogram (lateral view). The TS-SS was embolized with mechanically detachable coils. C) Post-embolization CT. the left temporal subcortical haemorrhage was revealed.

PVA particles entered into several cortical veins through the arteriovenous shunt and the patient resulted in venous infarction.

Vessel Perforation

There were two vessel perforations. Except one case, there were no new neurological deficits. In one case, a 47-year-old female suffered from transient Gerstmann syndrome.

Representative Case 3

47-year-old female with convulsion was admitted to our institution. Cerebral angiography showed the left TS-SS dural AVF with an isolated sinus (figure 3A). At first, we tried to access to the isolated sinus via the left jugular vein, however, resulted in fail. After transarterial embolization of the feeding arteries, we performed left temporo-occipital craniotomy and direct sinus packing using microcoils (figure 3B). An 18-gauge needle was introduced into the isolated sinus and we embolized it with several MDCs. When we searched other lumen within the sinus with a 0.035-inch guide wire, it entered into the draining vein without any resistance. After withdrawing the guidewire, extravasation was recognized by angiography. After complete embolization, a small left temporal subcortical haemorrhage was demonstrated on CT (figure 3C). The hematoma was not massive, so we followed the patient only with medication. She showed Gerstmann syndrome transiently and completely recovered.

Radiation-related Trouble

Some patients suffered from transient alopecia, however, transient skin necrosis with permanent alopecia occurred in one case.

Discussion

We encountered 5 abducent nerve palsies in CS dural AVFs. In these cases, transvenous embolization was performed under systemic heparinization to prevent from thromboembolic complications. The sinus at the shunt portion was tightly packed until the arteriovenous shunt was completely disappeared by cerebral angiography. Recently, we do not use systemic heparinization or neutralize heparin at the end stage of sinus packing for the CS to be embolized with small amount of coils. Postoperative abducent nerve palsy decreased after this procedure.

In the case of coil migration or unraveling, the stretched portion is weak and will be severed even if captured by the snare. It is also difficult to see the stretched portion at fluoroscopy. Therefore, it is necessary to capture the non-stretched portion. Our method of retrieval of the stretched coil from the internal jugular vein is useful for grabbing foreign bodies in which the caudal end is difficult to identify or fragile when captured.

To prevent from vessel perforation, we must know the characteristics of the catheters and guide wires used for embolization. In our case, we introduced a 0.035-inch guide wire into the cortical vein and perforated it. The most important thing to cope with vessel perforation is to recognize that the vessel perforation occurred. There are some methods to control the bleeding from the perforated vessels as follows. (A) stop anticoagulation, (B) do not withdraw the perforated device, (C) close the perforated point with another microcatheter or microcoils. In cases of dural AVF, the bleeding caused by vessel perforation is smaller than that of aneurysms or arteriovenous malformations. Therefore, we are not necessary to be in panic even if we caused vessel perforation.

Conclusions

There still exist minor complications in the endovascular treatment of dural AVFs. We can reduce these minor complications to know the possible complications related to the procedures and devices.

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